

PATENT COOPERATION TREATY

PCT

REC'D 21 OCT 2004

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 007/03	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/IT 03/00346	International filing date (day/month/year) 03.06.2003	Priority date (day/month/year) 22.07.2002
International Patent Classification (IPC) or both national classification and IPC C04B18/04		
Applicant STONE ITALIANA SPA et al.		



- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 4 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of 9 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 20.02.2004	Date of completion of this report 20.10.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Grundke, H Telephone No. +49 89 2399-8564 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/IT 03/00346

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17):*

Description, Pages

1-8 received on 20.07.2004 with letter of 20.07.2004

Claims, Numbers

1, 2 received on 20.07.2004 with letter of 20.07.2004

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/T 03/00346**

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1, 2
	No: Claims	
Inventive step (IS)	Yes: Claims	1, 2
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1, 2
	No: Claims	

2. Citations and explanations

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/IT03/00346

tem V:

Preliminary remark: There is an immediate apparent mistake at the end of present claim 1 in that the sentence is incomplete and must be completed in the form as used in original claim 1, namely "form of powders, grit or the like."

Reference is made to the following document/s/:

- D1: FR 720 972 A (IG FARBENINDUSTRIE AG) 26 February 1932 (1932-02-26)
- D2: CHEMICAL ABSTRACTS, vol. 115, no. 10, 9 September 1991 (1991-09-09)
Columbus, Ohio, US; abstract no. 98045j, page 360; XP000251440 & JP 03
075251 A (T. YOSHIMURA, ET AL.) 29 March 1991 (1991-03-29)
- D3: DATABASE WPI Week 199338 Derwent Publications Ltd., London, GB; AN
1993-301447 XP002260045 & SU 1 763 424 A (ZAPORO IND INST)
- D4: ",",SU-1763424-A,1-1993-301447,19/38,,,

The documents cited hereinabove essentially disclose what is set out at the bottom of page 4 of the description of the present claimed invention.

However, the art does neither describe nor give a hint for re-using those pure silicon fragments deriving from wasted electronic components, which surprisingly show a very high tensile strength in the resulting products together with resistance to abrasion and to acid environment.

Therefore present claims 1 and 2 meet the requirements of N, IS and IA.

TECHNICAL FIELD

The present invention refers to a sheet or slab or block made of an agglomerate material consisting of a recycled pure silicon-based mixture, a binder advantageously consisting of a resin and a filler advantageously consisting of quartz sand and/or crushed stone material.

More specifically, the present invention concerns sheets of agglomerate material which can be used for the construction of flooring or wall cladding, both internal and external.

The pure silicon raw material is mixed with the binders and fillers in the form of powder, grit or the like.

The present invention is of particular use in the building sector and in the manufacturing industry for the machining of marble, stone, granite and the like.

A further use of the agglomerate material according to the invention concerns the furnishing sector in general; more specifically, this material can be advantageously used in the production of shelves for kitchens or bathrooms, tables, counter-tops, stairs, etc.

BACKGROUND ART

Marble- and/or granite- and/or natural stone- and/or quartz sand-based agglomerate materials are known in the background art, the mixing of which makes it possible to obtain an artificial product which can be used as cladding and/or flooring material in general or

to obtain made-to-measure pieces such as steps, bathroom and kitchen worktops, window sills, etc.

Attempts are often made to give especially the visible surface of the object a particularly attractive appearance with considerable visual impact, sometimes resorting to the inclusion of metal powders or grits or of pieces of precious stones of various kinds, glass, mirrors, etc.

These attempts, consisting of the addition of colorants or of inserts of shiny material, have made it possible to obtain a product with a good degree of shine and an acceptable degree of surface mechanical resistance.

Natural stone does not present isotropic reflecting properties, which can on the other hand be achieved with an artificial agglomerate material which is stone-based together with other inserts.

These agglomerate materials are normally produced according to a production procedure which includes the following working stages:

- a first stage in which the various materials making up the agglomerate are crushed;
- a second stage in which the crushed materials are mixed, in order to obtain as homogeneous a product as possible, during which binders, for example resins, are added;
- a third stage in which the crushed materials are levelled and rolled;
- a fourth stage in which the crushed and rolled material is loaded into a distribution hopper;
- a fifth stage in which the hopper is unloaded in

order to load the crushed and rolled material into a distributor;

5 - a sixth stage of relative reciprocating translation of the distributor above special dies with simultaneous mixing of the material contained in the distributor;

10 - a seventh stage in which the material is discharged from the distributor into the dies designed to give the agglomerate material a well-defined configuration, for example of a tile or panel;

 - an eighth stage in which the agglomerate is pressed and compacted;

 - a ninth stage in which the tile or panel is hardened at a predetermined temperature;

15 - a tenth stage in which at least one side of the tile or panel is smoothed and polished;

 - an eleventh stage in which the tile or panel is cut to size, chamfered, gauged and flared, followed by unloading of the end product.

20 It should be remembered that the percentage of resin used in the above-mentioned mixtures is particularly important and should be established with great care and precision.

25 If the quantity of resin is too high, in fact, the sheet obtained will be too soft, with a closed-cell honeycomb structure which, during the subsequent vibration and vacuum pressing, does not allow the air trapped in the mixture to be released.

30 If, on the other hand, the quantity of resin is insufficient, the mixture will be particularly dry, with little cohesion and insufficient amalgamation during

vibration pressing.

It is known, moreover, that the hardness and the resistance to rubbing wear of sheets of agglomerate material can be increased by adding very fine silicon sand or powder to the mixture, which does not become impregnated with resin and acts as a filler material, allowing, at the same time, a reduction in the quantity of resin to be used.

One disadvantage is represented by the fact that while this agglomerate material presents sufficient mechanical features that allow it to be used for external cladding, it does not maintain its features unaltered over time.

One of the main problems that modern society has been forced to deal with as a result of the mass diffusion of IT products is the disposal and recycling of products and materials normally used in computers.

These materials include, for example, the wafers of very pure silicon used as a support for microchips, and for which an appropriate way of disposal and recycling has not yet been found. It would in any case be desirable to identify a method for the disposal and recycling of this material which is in itself expensive, but cannot be used again.

Document FR-A-720972 discloses a material containing silicon, suitable for covering a number of different articles and for building up a protecting layer on these articles. Chemical Abstracts, vol. 115, No. 10, 9 September 1991 & JP-A-03075251 describes a mortar composition comprising a small amount of metallic silicon powder. Document SU-A-1763424 discloses the use

of silicon deriving from metallurgical and chemical industry. Here silicon is mixed in water together with many other components such as refractor clay and graphite.

5

DESCRIPTION OF THE INVENTION

The present invention aims to eliminate or significantly reduce the known problems of the background art and to provide, therefore, a sheet or slab or block made of an agglomerate material presenting high mechanical resistance and an attractive appearance.

This is achieved by means of a sheet or slab or block made of an agglomerate material with the features described in the main claim, the raw material of which consists of recycled pure silicon.

The dependent claims describe particularly advantageous embodiments of the invention.

The agglomerate material according to this invention consists of a mixture comprising fragments of recycled pure silicon at a percentage normally between 1% and 75% varying in weight with respect to the total weight of the material, a binder between 5% and 15% in weight with respect to the total weight of the material, any colorants and aggregate consisting of crushed stone material and/or quartz sand to make up the weight of the mixture.

According to the invention, the pure silicon fragments are in the form of tablets, normally defined as "wafer" previously used as hardware components of processors and printed circuits for IT and industrial use.

The agglomerate material according to this invention presents excellent physical and mechanical features that do not alter over time, together with a good degree of shine.

- 5 The resulting sheets can be advantageously used for internal flooring in buildings, to construct a worktop for a table or a kitchen or can be used for flooring and cladding of any kind.

- 10 This agglomerate material, with inserts in recycled silicon, also presents a high ultimate tensile strength together with resistance to abrasion and to particularly acid environments.

- 15 The artificial agglomerate material according to this invention also has a high degree of resistance to atmospheric agents, chemical agents and rubbing wear, allowing the construction of particularly long-lasting artificial tiles or paving slabs that maintain their appearance for a long time.

- 20 Two non-binding examples are described below of the formulation of the agglomerate material according to the invention for obtaining sheets by means of procedures known to the background art.

* * * * *

25

DESCRIPTION OF SOME FORMS OF EMBODIMENT

- 30 The examples described below indicate the components of the recycled silicon-based agglomerate material according to the invention and their percentages in weight with respect to the total weight of a sample of the material, except for the colorant for

which no specific percentage is indicated.

EXAMPLE 1

	SSTD stone material with granulometry from 0.3 to 0.8	
5	millimetres	9.70%,
	SSFR stone material with granulometry from 0.1 to 0.3	
	millimetres	14.82%,
	fragments of silicon tablets	41.83%,
	quartz 64/100	25.76%,
10	Lonza resin	7.89%.

ESEMPIO 2

	SSTD stone material with granulometry from 0.3 to 0.8	
	millimetres	7.50%,
	SSFR stone material with granulometry from 0.1 to 0.3	
15	millimetres	11.44%,
	fragments of silicon tablets	50.63%,
	quartz 64/100	22.12%,
	Lonza resin	8.31%.

20 The silicon tablets are recycled from previous use as wafers supporting microchips and printed circuits used as electronic component hardware.

25 The fragmentation of these tablets can present a fine granulometry of the order of a few tenths of a millimetre up to granulometric values of a few millimetres.

30 If the agglomerate material is produced in blocks and subsequently cut into sheets, or other appropriate shapes according to specific requirements, the cut surfaces also present excellent reflecting properties since the silicon fragments have an extremely fine

granulometry so as to isotropically preserve their shine features.

The invention is described above with reference to some particular forms of embodiment.

5 It is nevertheless clear that the invention is not limited to these forms of embodiment but includes all the modifications and variations that can be considered, without going beyond the scope of this invention as claimed.

10 For example, in addition to foreseeing the possible use of polymerisation catalysts and accelerators, the invention can foresee the insertion of various types of materials in the mixture, such as fragments of metal or wood, or glass microspheres, etc.

CLAIMS

1. A sheet or slab or block made of an agglomerate material consisting of a mixture comprising at least one raw material between 1% and 75% varying in weight with respect to the total weight of the material, a binder between 5% and 20% in weight with respect to the total weight of the material, a colorant and a filler aggregate such as crushed stone material and/or quartz sand to make up the weight of the mixture, characterised in that said raw material is constituted by fragments, in the form of powders, grit or the like, of pure silicon tablets previously used in the electronic industry as wafer supporting microchips and printed circuits silicon tablets, this raw material being mixed with the above components in the.
2. A sheet or slab or block according to claim 1, characterised in that the granulometry of the silicon tablet fragments varies from a few tenths of a millimetre to a few millimetres.